

Attitudes Toward Wildlife Species Protection: Assessing Moderating and Mediating Effects in the Value-Attitude Relationship

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Abstract: Framed in the cognitive hierarchy approach, we examine (1) the mediating effect of general environmental attitudes and (2) the moderating effect of factual wildlife knowledge on the relationship between values and specific wildlife attitudes (wildlife species protection). These relationships are assessed across four wildlife constituent groups: (1) consumptive users (anglers and hunters), (2) birders (a nonconsumptive user group), (3) non-hunters, non-anglers, and non-birders (nonusers), and (4) combined consumptive and nonconsumptive users (anglers, hunters and birders). Twelve hundred and twenty residents of the Southern Appalachians completed a telephone survey during the summer of 1995. Overall, respondents demonstrated low knowledge but favorable attitudes regarding wildlife species protection. Results provided partial support for a cognitive hierarchy in which general attitudes mediate the relationship between values and specific attitudes, and the existence of knowledge as an external moderating variables. Results are discussed in the context of information-processing theories and implications for developing effective fish and wildlife communication strategies are considered.

Keywords: Cognitive hierarchy, environmental attitudes, wildlife attitudes, environmental values, wildlife recreation, wildlife knowledge

Understanding public attitudes is integral to effective fish and wildlife management for, at least, the following reasons: (1) wildlife agencies are legally mandated to involve publics (and to consider their respective opinions) in the decision-making process (e.g., Magnuson Fishery Conservation and Management Act, 1976); (2) attitudes predispose behavior (such as generating support for wildlife species protection or controlling detrimental human actions); (3) a changing and more diverse wildlife constituency has made it increasingly difficult to predict human responses to management actions; and (4) managing fish and wildlife on an ecosystem basis requires that human dimensions (including public attitudes and values) are considered along with biophysical information. However, while many Americans demonstrate strong emotional attachments to fish and wildlife, the basis for their attitudes is often unclear (Decker, Brown, & Mattfield, 1989; Kellert & Berry, 1987; Kellert & Brown, 1985; Manfredo, Vaske, & Decker, 1995; Mangun, 1992). It has been suggested, for example, that public attitudes toward wildlife are "motivated more by myth and bias than by knowledge and informed opinion" (Kellert & Brown, 1985, p.276). To the extent that attitudes regarding fish and wildlife are influenced by individual values and/or knowledge, public responses to programs and policies may not only be anticipated, but also modified and changed to meet agency directives.

Theoretical Orientation

Cognitive response theories propose that attitudes (1) are based on values, (2) tend from the general to the specific, and (3) predict future behaviors and intentions (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Heberlein, 1981; Rajecki, 1982; Tesser & Shafer, 1990). Such an approach recognizes a hierarchical framework in which values provide the basis for forming general attitudes, which in turn elicit specific attitudes. Consistent with the notion of attitude-behavior specificity (Ajzen & Fishbein, 1980; Weigel & Weigel, 1978), general attitudes are considered valid predictors of general behaviors, while specific attitudes are more strongly related to specific actions. Recent work in fish and wildlife has provided partial support for a "cognitive hierarchy" in which attitudes were found to mediate the relationship between wildlife values and behavioral intentions (Fulton, Manfredo, & Lipscomb, 1996).

Other work has suggested that external non-attitudinal factors may affect the linkages between values, attitudes and behaviors (Ajzen & Fishbein, 1980; Schwartz & Tessler, 1972; Zanna, Olson & Fazio, 1980). In the context of natural resource issues, a critical variable, external to one's attitude toward an issue, is the level of factual or objective knowledge about that issue (Kellert & Brown, 1985; Manfredo et al., 1995). As issues related to natural resource and wildlife management policies become increasingly complex, there is a need to ensure that the public is

sufficiently knowledgeable to participate in the decision making process and to have well-informed opinions. From a theoretical perspective, knowledge has been shown to link public values with attitudes and preferences. Pierce, Lovrich, Tsurutani and Abe (1989), for example, found that individuals with higher levels of factual knowledge about the environment possessed attitudes toward environmental policies that were more consistent with their fundamental values, illustrating a moderating effect for knowledge. It is not known, however, if knowledge plays a moderating role in the formation of attitudes toward fish and wildlife issues that are based on the values that individuals possess.

Research Objectives

Using the context of wildlife species protection, we examine (1) the mediating effect of general environmental attitudes and (2) the moderating effect of knowledge on the relationship between values and specific attitudes. These relationships are assessed across four wildlife constituent groups: (1) consumptive users (anglers and hunters), (2) nonconsumptive users (birders), (3) nonusers (non-hunters, -anglers, and -birders), and (4) combined consumptive and nonconsumptive users (anglers, hunters and birders).

Mediating Role of Attitudes

A mediating effect occurs when a variable "accounts for the relation between the predictor and the criterion" (Baron & Kenny, 1986, p.1176). For example, in the cognitive hierarchy, the impact of values on specific attitudes may be mediated through general attitudes. Three conditions are required for a mediation effect to occur (Baron & Kenny, 1986; James & Brett, 1984): (1) a significant relation between the predictor (e.g., values) and the mediator (general attitudes); (2) a significant relation between the criterion (specific attitudes) and the mediator; and (3) when the effect of the mediator is controlled, the relation between the predictor and the criterion should not be significant (and theoretically equal to zero).

Predictor. Values represent fundamental cognitions that transcend specific situations and are assumed to be the foundation for attitudes (Fulton et al., 1996; Heberlein, 1981). At the individual level, there are at least two types of values: held and assigned. Held values are modes of conduct (e.g., honesty), end-states (e.g., equality), or qualities (e.g., beauty) that individuals possess (Rokeach, 1973). Assigned value refers to the relative worth or importance of an object (or thing) relative to other objects (Brown, 1984). The two value types are not independent and it has been argued that assigned values reflect a person's held values (Bengston, 1994; Brown, 1984). There is precedence for measuring assigned value in natural resource (Bengston, 1994) and wildlife management (Purdy & Decker, 1989; Steinhoff, 1980). In the present study, we measure assigned value toward the natural environment, because this represents a basic core value that is likely to influence attitudes toward specific environmental issues such as wildlife species protection.

Criterion. Understanding public opinions about specific issues can assist managers to develop communication strategies aimed at producing more favorable support for policy actions, expand into new program areas, and identify new user constituencies (Kellert & Berry, 1987; Purdy & Decker, 1989). In the present study, we examine the basis for public attitudes toward wildlife species protection.

Mediator. In the cognitive hierarchy approach, general attitudes are proposed to mediate the relationship between values and specific attitudes (Fishbein & Ajzen, 1975; Fulton et al., 1996; Heberlein, 1981). In the context of fish and wildlife management, general attitudes might refer to broadly held beliefs about natural resources and the physical environment. Since the early 1970s, several scales to assess public attitudes toward general environmental issues have been developed (e.g., Dunlap & Van Liere, 1978; Maloney, Ward & Braucht, 1975; Roper Organization, 1990; Stern, Dietz & Kalof, 1993; Weigel & Weigel, 1978).

Moderating Effect of Knowledge

A moderating effect occurs when the predictor-criterion relationship changes as a function of an external factor (Baron & Kenny, 1986; Hines, Hungerford & Tomera, 1987; Iwasaki & Mannell, 1996). For example, knowledge may be considered a moderator if the relation between values and specific attitudes is significantly different (in magnitude and/or direction) for low versus high knowledge groups. Ideally, the moderator should be uncorrelated with the predictor and the criterion (Baron & Kenny, 1986).

The American public has been shown to exhibit generally low levels of factual knowledge regarding environmental (Council on Environmental Quality, 1980; Kuklinski, Metlay & Kay, 1982) and fish and wildlife (Kellert & Brown, 1985) issues. Furthermore, knowledge is, at best, only slightly related (with correlations less than .30) to both environmental values and attitudes (e.g., Arcury, 1990; Borden & Schettino, 1979; Cohen, 1973; Dahlgren, Wywiałowski, Dubolz & Wright, 1977; Maloney & Ward, 1973; Maloney et al., 1975; Morgan & Gramman, 1989; Ramsey & Rickson, 1976; 1977). Morgan and Gramman (1989), for example, found that students' knowledge of snakes explained less than 4% of the variance in their attitudes toward snakes; while, Dahlgren et al. (1977) reported a correlation of .27 for wildlife knowledge and attitudes toward hunting. While the lack of a strong relationship between knowledge and values or attitudes has important implications for fish and wildlife management, it does not negate the hypothesis that knowledge may moderate the value-attitude relationship. This hypothesis is important to examine because, if supported, it suggests that values provide a foundation for forming attitudes toward fish and wildlife issues that are dependent upon an individual's level of knowledge about the issue. In other words, individuals with greater knowledge may possess attitudes toward fish and wildlife issues that are more in line with their basic values.

Wildlife Constituency

Values, attitudes and knowledge are experience dependent (Dunlap & Heffernan, 1975; Kellert, 1984; Newhouse, 1989; Zanna & Rempel, 1988). Kellert (1984), for example, found that children who watched birds and/or hunted were more knowledgeable and concerned about wildlife than children who did not bird or hunt. Similarly, fishing experience was the strongest predictor of preferences for fish management strategies (Schoolmaster & Frazier, 1985). These findings suggest that the mediating effect of general attitudes, and the moderating role of knowledge, on the value-specific attitude relationship is likely to be determined by the type of user group. The wildlife constituency consists of traditional consumptive users (hunters and anglers), nonconsumptive users (e.g., bird-watchers, fish-watchers) and the non-utilizing public (Kellert & Brown, 1985). The recent National Survey on Recreation and the Environment (1995) reports that in a 12-month period, 27.0%, 29.1% and 9.4% of adults (>15 years old) bird-watched, fished and hunted, respectively. In many cases, outdoor recreation activities such as hunting, fishing and bird-watching provide the only context by which individuals experience fish and wildlife resources.

Methods

Sampling

Twelve hundred and twenty telephone interviews with household residents of the Southern Appalachians (SAs) were conducted during the summer of 1995 by the Human Dimensions Research Laboratory at the University of Tennessee. The SAs is an area extending south of the Potomac River to northeast Alabama and northern Georgia, and includes the mountain and valley regions of Virginia, West Virginia, North Carolina, Tennessee, South Carolina, Georgia and Alabama. Respondents were selected by asking for the individual in the household with the most recent birthday. Telephone numbers were generated using the random-digit dialing method. A quota sampling procedure was used to ensure an equal sample size (approximately 600) for both rural and urban residents.

Variable Measurement

Objective knowledge of wildlife species protection was measured using five "true/false/don't know" statements developed in cooperation with representatives of state and federal fish and wildlife agencies in the SAs (Table 1). Correct responses were scored as one and incorrect responses (including "don't know") received zero. Knowledge scores ranged from zero to five.

Assigned value of the environment was measured by asking subjects to rank four issues in order of personal importance: "reducing the national debt," "protecting and rehabilitating the natural environment," "reforming

Table 1
Frequency of Responses to Factual Knowledge
of Wildlife Species Protection

Statement (with correct response)	% Reporting		
	True	False	Don't Know
Both plants and animals are included on the Threatened and Endangered Species List (True)	72.3	12.6	15.1
A threatened species is one that is near extinction (False)	69.5	16.6	13.9
In Southern Appalachia, more animals and fish are killed by hunting and fishing than from removal of habitat (False)	37.5	38.9	23.7
In Southern Appalachia, more species of fish, crayfish and mussels are threatened and endangered than species of mammals such as bears and wolves (True)	43.7	21.8	34.5
Rainbow trout are native fish in Southern Appalachia (False)	51.6	18.6	29.8

national health care," and "reducing crime." Items were randomly ordered when presented to respondents. A score of four was assigned when the respondent indicated the environment was of most importance, a score of three when the environment was rated as the second most important issue, two for the third, and one for when the environment was considered to be the least important of the four issues.

General environmental attitude was measured using one of the following five scales: the New Environmental Paradigm (NEP) (Dunlap & Van Liere, 1978), the Environmental Concern (EC) scale (Weigel & Weigel, 1978), Awareness of Consequences (AC) scale (Stern, et al., 1993), a modified version of the Forest Values (FV) scale (inserting the word "environment" for "forest") (Steel, List & Schindler, 1994) and an environmental perceptions scale developed by the Roper Organization (ROPER) (1990). All scales used the same five-point "strongly agree" to "strongly disagree" scale with a mid-point of "neither." Respondents were randomly administered one of the scales. Although previous research by Tarrant and Cordell (in press) has found the five environmental scales to be moderately related with a general environmental behavior index (*r*'s ranging from .27 to .48) implying a degree of predictive validity, intercorrelations among the environmental scales were not measured and construct validity

could not be determined. For this reason, the five scales were treated separately in the present study.

Attitude toward wildlife species protection was assessed using an index of four statements (Table 2) that were identified by fish and wildlife experts in the SAs region as being of critical importance to managers. A five-point "strongly agree" to "strongly disagree" scale, with a mid-point of "neither" was used. Scores on the index could range from four (most strongly disagree) to 20 (most strongly agree).

Table 2
Frequency of Responses to Attitudes Toward
Wildlife Species Protection

Statement	% Reporting		
	Agree	Disagree	Neither
Land that provides critical habitat for plant and animal species should not be developed	72.5	22.5	4.7
The Endangered Species Act has gone too far and should be restricted ¹	33.6	57.5	8.9
It is more important to protect habitat for trout than nongame fish ¹	29.3	53.0	17.7
More fish should be stocked in streams and lakes to provide increased sportfishing opportunities ¹	62.8	24.4	12.8

¹ Items reverse coded.

All respondents were asked (on a dichotomous "yes/no" scale) if they had, in the past year, watched birds, hunted, and/or fished. The nonuser group was comprised of respondents who did not report participation in any of these three activities. The nonconsumptive recreation group included only those who watched birds and did not hunt and/or fish.¹ The consumptive group was made up of those who hunted and/or fished but did not watch birds. Respondents who hunted and/or fished and watched birds comprised the combined consumptive/nonconsumptive recreation group.

Analysis

All analyses were conducted using SPSS/PC+ Version 4.01 (Norusis, 1991) with a significance level of $p = .05$. To test for mediation of general environmental attitudes on the relationship between assigned environ-

mental value (predictor) and attitudes toward wildlife species protection (criterion) (objective #1), a series of regression equations were performed (see Baron & Kenny, 1986) in which (1) criterion was regressed on the predictor to establish a relationship between these two factors, (2) the mediator was regressed on the predictor to test for condition 1 necessary for mediation, and (3) the criterion was regressed on both the predictor and the mediator to test for conditions 2 and 3 for mediation. To determine mediation, the relationship between the predictor and the criterion must be less in (3) than in (1). This procedure was conducted for each of the four wildlife constituent groups.

To examine the effect of knowledge as a moderator on the value-attitude relationship (objective #2), a test of the correlation coefficients for the two levels of the moderator (high versus low knowledge) was performed using the Fisher's Z-transformation.² First, knowledge was coded as a dichotomous variable (low versus high) based on scores either below or above the median value (2.0) for the five-item knowledge scale. Second, coefficients between the predictor and the criterion were determined for the low and high knowledge groups. Third, the coefficients were transformed to z-scores and a test of the difference between the two correlations (high versus low knowledge) was conducted. This procedure was undertaken for each of the wildlife constituent groups.

Results

Response Rate

Almost 6,000 telephone numbers were generated during the data collection period. One-fifth (21.1%) were disconnected numbers and 9.7% were business or fax numbers. In total, 2,829 people were contacted. Of these, 54.4% refused to participate in the survey and 1.8% terminated partway through the interview. A total of 1,220 people completed the telephone survey (response rate of 43.8%). Of these, 20.3% (n = 248) were birders, 25.4% (n = 310) hunted and/or fished, 27.0% (n = 329) were nonusers, and 27.3% (n = 333) birded and hunted and/or fished.

Descriptive Results

Correct responses to each of the five objective knowledge statements ranged from 16.6% ("a threatened species is one that is near extinction") to 72.3% ("both plants and animals are included on the Threatened and Endangered Species List") with a mean score of 1.90 and a median of 2.0 out of 5.0 (Table 1). The environment was rated as the most important issue for 19.0% of subjects, second for 27.6%, third for 35.2% and of least importance for 18.2%. (The item perceived as the most important overall was reducing crime.) Generally, respondents indicated a strong positive attitude toward the environment; mean scores and standard deviations for the five scales were: NEP (3.69, .42), EC (3.57, .55), ROPER (3.34, .30), AC

(3.93, .30), and FV (3.26, .24). Reliability estimates (measured using Cronbach's alpha) for the five environmental attitude scales were moderate to low: .75 (NEP), .78 (EC), .72 (AC), .55 (FV), and .58 (ROPER). Overall, respondents demonstrated a mixed attitude toward wildlife species protection (Table 2). Almost three-quarters thought that critical habitats should not be developed, but over one-third felt that the Endangered Species Act should be restricted. Most (53.0%) agreed that nongame fish habitat should be protected over habitat for trout, yet, almost two-thirds supported the stocking of fish to increase sport fishing. The mean attitude score was 12.97 out of 20.0 (S.D. = 2.61).

Differences in Wildlife Constituent Groups

Table 3 shows that birders demonstrated significantly more favorable attitudes toward wildlife species protection than consumptive users; greater knowledge, more favorable attitudes toward wildlife species protection, and stronger environmental values than nonusers; and more favorable attitudes toward wildlife species protection than those who birded and hunted and/or fished. There were no significant differences between consumptive users and nonconsumptive users in their levels of knowledge and assigned environmental values. Users who participated in both consumptive and nonconsumptive activities demonstrated significantly higher levels of knowledge than any other group and stronger environmental values than nonusers; but did not differ from hunters/anglers or birders on environmental values. Differences in environmental attitudes across the four groups were observed for only one of the five scales (EC), where birders exhibited significantly more favorable environmental attitudes than consumptive users or nonusers.

Objective #1

Table 4 shows the results of mediation analysis. The purpose of this analysis was to examine whether the three conditions necessary for mediation were met. Three regressions were conducted for this analysis. Regression 1 establishes a relationship between the predictor (assigned value) and the criterion (specific wildlife attitude). For all groups, there was a significant relationship at $p < .001$ (r's ranging from .20 to .40). To test for mediation, two additional regressions are required to ensure that all three conditions necessary for mediation are met. Regression 2 establishes a relationship between the predictor (assigned value) and the potential mediator (general environmental attitudes). For nonconsumptive, consumptive and nonconsumptive/consumptive users, significant relations were found for three to four of the five scales used, partially satisfying the first condition for mediation. For nonusers, only two of the five environmental attitude scales produced significant relations.

To examine the final two conditions for mediation, the criterion (specific wildlife attitude) is regressed on both the potential mediator (general environmental attitudes) (regression 3a) and the predictor (assigned value) (regression 3b). Regression 3a was satisfied, generally,

Table 3
A Comparison of Nonconsumptive (Birders'), Consumptive (Hunters' and Anglers'), Nonusers', and Combined Consumptive/Nonconsumptive Users' Wildlife Attitudes, Wildlife Knowledge, Assigned Environmental Values, and Environmental Attitudes.¹

	Nonconsumptive (birders)		Consumptive (Hunters/anglers)		Nonusers		Consumptive/ Nonconsumptive		F	p
	Mean	S.D.	Mean	S.D.	Mean	S.D.	S.D.	Mean		
Wildlife attitudes ²	13.58 ^b	2.70	12.69 ^a	2.56	12.91 ^a	2.58	12.85 ^a	2.55	4.99	.002
Wildlife knowledge ³	1.86 ^b	1.25	1.94 ^b	1.84	1.56 ^a	1.03	2.22 ^c	1.22	18.35	<.001
Assigned environmental values ⁴	2.56 ^b	1.02	2.55 ^b	1.00	2.20 ^a	0.96	2.60 ^b	0.98	10.65	<.001
Environmental attitudes ⁵										
NEP	3.62	0.63	3.77	0.41	3.57	0.48	3.75	0.50	2.02	.113
EC	3.77 ^b	0.40	3.50 ^a	0.46	3.47 ^a	0.37	3.68 ^{a,b}	0.54	4.21	.007
ROPER	3.38	0.47	3.34	0.60	3.30	0.40	3.34	0.39	0.24	.870
AC	4.06	0.44	3.88	0.48	3.86	0.52	3.90	0.46	2.17	.093
FV	3.38	0.57	3.21	0.42	3.15	0.40	3.28	0.36	2.37	.071

¹ Different alphabetical superscripts refer to significant differences in mean scores

² Attitudes toward wildlife species protection measured on a response scale of 4 (strongly disagree) to 20 (strongly agree)

³ Knowledge of wildlife species protection measured on a response scale of 0 (no knowledge) to 5 (high knowledge)

⁴ Assigned environmental value measured on a response scale of 1 (least important) to 4 (most important)

⁵ General environmental attitude scales measured on a response scale of 1 (strongly disagree) to 5 (strongly agree)

Table 4
Mediating Effect of General Environmental Attitudes on the Relationship between Assigned Environmental Values and Attitudes toward Wildlife Species Protection by Wildlife User Constituent Group

	Nonconsumptive (birders)		Consumptive hunters/anglers		Nonusers		Consumptive/ Nonconsumptive	
	Beta	n	Beta	n	Beta	n	Beta	n
Regression 1 (predictor and criterion)	.40***	201	.20**	268	.37***	247	.24***	281
Regression 2 (predictor and mediator)								
NEP	.57***	31	.25	60	.39**	53	.53***	55
EC	.16	28	.36*	48	.13	60	.42**	43
ROPER	.48**	41	.48**	53	.26	52	.35*	52
AC	.51***	57	.02	47	.42**	45	.39**	62
FV	.26	44	.38**	60	.21	37	.18	69
Regression 3a (mediator and criterion)								
NEP	.53*	31	.36**	60	.33*	53	.64***	55
EC	.55**	28	.46**	48	.54***	60	.65***	43
ROPER	.44*	41	.75***	53	.34*	52	.27	52
AC	.34*	57	.25	47	.33*	45	.36*	62
FV	.46***	44	.61***	60	.53**	37	.22	69
Regression 3b (predictor and criterion)								
NEP	.18	31	.29*	60	.19	53	.23	55
EC	.24	28	.01	48	.38*	60	.16	43
ROPER	.21	41	.15	53	.02	52	.24	52
AC	.22	57	.09	47	.30	45	.06	62
FV	.31*	44	.03	60	.27	37	.12	69

* p < .05

** p < .01

for all four groups in that there was a significant relationship between the mediator (general environmental attitudes) and the criterion (specific wildlife attitude) for 17 of the 20 regressions at $p < .05$ (r 's ranging from .33 to .75). (The three nonsignificant regressions were all greater than .20.) For condition 3 to be satisfied, the relationship between the predictor and the criterion should not be significant when the mediator is controlled for (regression 3b). Table 4 shows that only three of the 20 regressions in regression 3b were significant, suggesting that, in general, environmental attitudes mediated the predictor-criterion relationship for all four wildlife constituent groups.

Objective #2

Table 5 shows predictor-criterion relationships by level of knowledge (low versus high) for each of the four wildlife constituent groups. Overall, correlations were strongest for nonusers. Knowledge proved to be a significant moderator for two of the four groups: consumptive users ($z(r_1 - r_2) = 2.40$) and combined consumptive/nonconsumptive users ($z(r_1 - r_2) = 2.07$). For consumptive users, higher levels of knowledge significantly increased the correlation between values and specific attitudes (r 's = .33 and .04 for high versus low knowledge groups); for combined user groups, higher levels of knowledge significantly decreased the predictor-criterion correlation (r 's = .17 and .38 for high versus low knowledge groups).

Conclusions and Discussion

This study examined (1) the mediating role of general environmental attitudes and (2) the moderating effect of wildlife knowledge on the relationship between environmental values and attitudes toward wildlife species protection across four primary wildlife constituent groups. Results provide partial support for a cognitive hierarchy in which general environmental attitudes mediate the relationship between environmental values and specific wildlife attitudes. There is also some support for the existence of knowledge as an external moderating variable. While higher levels of knowledge significantly improved the prediction of attitudes toward wildlife species protection from environmental values for the traditional wildlife-consumptive group, the opposite was true for the combined user group (i.e., lower levels of knowledge improved the value-specific attitude relationship). Before discussing implications of these findings for fish and wildlife management, at least three limitations to the study should be recognized.

Limitations

First, we measured only assigned values, not held. While a number of fish and wildlife studies have used this approach (e.g., Purdy & Decker, 1989; Steinhoff, 1980), including held values would not only help establish

Table 5
Moderating Effect of Wildlife Knowledge on the Correlation (r) Between Assigned Values and Attitudes Toward Wildlife Species Protection by Wildlife User Constituent Group

	Low knowledge				High knowledge				$z(r_1 - r_2)$
	r_1	z-score	t	p	r_2	z-score	t	p	
Nonconsumptive (birders)	.20	.20	1.28	.209	.34	.36	2.75	.008	70
Consumptive (hunters/anglers)	.04	.04	0.28	.779	.33	.34	3.27	.002	93
Nonusers	.37	.39	3.19	.002	.47	.50	4.99	<.001	58
Nonconsumptive/Consumptive	.38	.40	3.17	.002	.17	.17	1.56	.122	130

* Significant at $p < .05$

the basis for assigned values in the cognitive hierarchy (Rokeach, 1968), but would also provide information useful for the establishment of ecosystem management that calls for managing natural resources for multiple values (versus uses) (Bengston, 1994). A related concern is the failure to measure wildlife value orientations (i.e., basic beliefs about wildlife) as a possible mediator of the assigned value-general attitude relationship (see for example, Fulton et al., 1996). Furthermore, we did not examine the relationship between attitudes and behavior. Clearly, this is an important area for future research.

A second limitation to the study concerns the measurement of objective knowledge. Only one group (combined consumptive/nonconsumptive users) averaged more than 40% correct responses on knowledge about wildlife species protection. Although this is not inconsistent with other studies that have shown public misconceptions about wildlife (e.g., Kellert & Berry, 1987; Kellert & Brown, 1985; Morgan & Gramman, 1989), there have been studies that have shown public knowledge of natural resources to be quite high (e.g., Reading, Clark & Kellert, 1994). These conflicting findings suggest more work should be directed toward the development of valid knowledge scales (see also Arcury & Johnson, 1988).

Third, it is not known to what extent the five environmental scales are correlated and are, therefore, specifically measuring the same latent construct. Although predictive validity has previously been demonstrated, the scales may not necessarily be considered similar measures of general environmental attitudes. A related concern is that two of the scales (ROPER and modified FV) did not reach acceptable levels of internal reliability (α of .60 or better); however, in both cases the reliability coefficients were very close to .60.

Conclusions

Attitudes toward wildlife species protection not only reflect assigned environmental values, but are affected by general attitudes toward the environment and, to some extent, wildlife knowledge levels. It is not surprising that general environmental attitudes acted as a significant mediator because they represent symbolic (i.e., value-laden) beliefs. Such beliefs have been found to be important predictors of attitudes toward specific government policies (e.g., Sears, Lau, Tyler & Allen, 1980) and wolf reintroduction (Bright & Manfredi, 1996). The moderating role of knowledge is consistent with earlier findings that individuals with greater knowledge have attitudes toward environmental policies that are more in line with their fundamental values (e.g., Pierce et al., 1989). There are, however, at least two fundamental questions that arise from the test for moderation: (1) why is knowledge not a significant moderator for nonusers and birders? and (2) why would increased knowledge reduce the effect of values on specific attitudes for combined consumptive/nonconsumptive user groups?

To address the first question, it is important to recognize that both nonusers and birders obtained the lowest knowledge scores, suggesting that the difference between high versus low knowledge for these two groups may not have been as great as for hunters/anglers and the combined consumptive/nonconsumptive groups. This lack of statistically significant differences may be a function of the size of the samples. Sample sizes for the high knowledge groups were considerably smaller for both nonusers ($n = 58$) and birders ($n = 70$) than for hunters/anglers ($n = 93$) and combined consumptive/nonconsumptive users ($n = 130$). This result may also reflect the nature of attitudes of low versus high knowledge individuals. Attitudes of individuals who have low knowledge of an issue (in this study, more likely to be nonconsumptive users and nonusers) may be less formed than attitudes based on high levels of knowledge, making the effects of various external factors such as knowledge and values on specific attitudes less predictable.

To address the second question, it is important to recognize the relative importance of the moderator and predictor in explaining variance in the criterion. Moderation occurs because the relation between the predictor and criterion changes as a function of the moderator. In our study, increased knowledge improved the value-attitude relation for consumptive users; i.e., for individuals with higher knowledge levels, attitudes about wildlife species protection were based on, and aligned with, their environmental values. This finding is consistent with previous work (e.g., Pierce et al., 1989). However, for the combined user group, lower (rather than higher) knowledge levels improved the predictive validity of values; i.e., individuals with higher knowledge relied less strongly on their values to form attitudes about wildlife species protection. Why did this occur? One explanation might be that people who participated in both nonconsumptive and consumptive activities demonstrated such high knowledge scores (relative to the other three wildlife constituent groups) that they relied more heavily on existing knowledge to form attitudes; i.e., knowledge functioned as the primary predictor variable in accounting for variance in specific attitudes. Tybout and Scott (1983) have argued that when knowledge is readily available, attitudes are formed by retrieving stored information about the object/issue. It is likely, therefore, that when knowledge about wildlife species protection is available to respondents, they rely less on assigned values to form attitudes about wildlife species protection and rely more on information stored in memory. To test this hypothesis, we conducted additional analysis that examined the effect of both knowledge and assigned value on attitudes toward wildlife species protection using the multiple regression (stepwise) procedure in SPSS/PC+. Results showed that for birders and nonusers, knowledge had lower predictive validity ($r = .16$ and $.09$, respectively) than assigned value ($r = .36$ and $.37$, respectively); for anglers/hunters, knowledge and value had similar predictive validity ($r = .17$ and $.18$, respectively); while, for combined consumptive/nonconsumptive users,

Knowledge had stronger predictive validity ($r = .26$) than value ($r = .21$). It is not surprising that people who participate in both consumptive and nonconsumptive wildlife activities rely more on knowledge than values to form specific attitudes about wildlife. Because nonconsumptive users have stronger pro-environmental attitudes (Jackson, 1986) and more preservationist-oriented beliefs about wildlife (Fulton et al., 1996), these two value orientations could produce internal conflict for people who both bird and hunt/fish. Because people are motivated to reduce the cognitive dissonance produced by conflict (Festinger, 1957), one solution is to rely on other sources of information (such as knowledge) to form attitudes.

Implications

With the growing tendency for the public to become more involved in decisions regarding the management of wildlife resources, there are practical implications to a greater understanding of the relationships among public values, attitudes and knowledge. First, attitudinal information can help managers understand the diverse sides of wildlife management issues. Increasingly, the management of viable natural ecosystems can represent a multiplicity of public values (Bengston, 1994). Given that they must manage natural and wildlife resources in the public interest, managers must recognize the extent to which these values drive public attitudes toward specific issues. In this study, the extent to which values drive attitudes differed between wildlife users and nonusers. This makes reliance on values as a gauge of public attitudes only relevant for groups whose values actually drive their attitudes.

Second, a significant amount of research in social psychology and natural resource management, among others, has supported the notion that attitudes predispose or predict behavior. Such behavior may take an active form, as with appropriate hunting behavior on public lands, or a more passive form, such as support for specific management practices related to fish and wildlife issues. This is important because many decisions regarding wildlife-related issues are being brought forward to the public through ballot initiatives. To illustrate, spring black bear hunting was eliminated by voters in Colorado in 1992. A ballot initiative to forbid the use of hounds and bait for hunting bears passed in Oregon in 1994 and Washington in 1996, and failed in Idaho in 1996. Regardless of the outcome of these initiatives, it is apparent that wildlife managers must understand the nature of public attitudes and the resulting behavior. For example, are attitudes toward hunting techniques related to values based on animal welfare or values based on the perceived role of the public in wildlife management policy making?

Understanding the nature of attitudes is complicated by the moderating effects of knowledge of the issue. This complication occurs for two reasons. First, the relationship between assigned value and attitudes toward the issue were different among consumptive recreationists de-

pending on their level of knowledge of the issue, slightly confounding the issue of what to include in a persuasive communication to this group. Second, communication campaigns may have different effects on knowledgeable recreationists than those with little knowledge independent of the nature of other external factors. Manfredo and Bright (1991) found that knowledgeable users of the Boundary Waters Canoe Area Wilderness were less likely to elaborate on USFS information and be influenced by it than were less knowledgeable users. This suggests that not only is the content of the message provided to different constituencies complicated and problematic, but so is the issue of how to get various groups to even examine the message in the first place.

Endnotes

¹ Although nonconsumptive recreation includes activities other than bird-watching (e.g., fish-watching, viewing wildlife, cross-country skiing, etc.), for the purposes of this study, the term "nonconsumptive recreation" will be used to describe bird-watching.

² The procedure is described in detail in Cohen & Cohen (1983) and Shavelson (1988).

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